WHAT IS CLAIMED IS

1. A multi-beam scanning device, scanning a to-be-scanned surface with a plurality of laser beams simultaneously, comprising:

a light-source unit comprising a plurality of laser arrays, each comprising a plurality of light-emitting points, a corresponding plurality of coupling lenses coupling laser beams emitted from said plurality of laser arrays, respectively and a holding member integrally holding said plurality of laser arrays and plurality of coupling lenses rotatably approximately about optical axes of said laser arrays; and

a scanning optical system deflecting the laser beams emitted from said light-source unit and imaging them onto the to-be-scanned surface,

wherein said light-source unit and scanning optical system are configured so that the following equation be satisfied:

$$AY = |q \times \cos\phi \times mY \times (n-1) / (2 \times fcol \times \tan\theta \times \cos\gamma \times mZ)| \leq 0.1$$

where:

n denotes the number of light-emitting points on each laser array;

q denotes an interval between each adjacent ones of the light-emitting points on each laser array;

ϕ denotes an inclination angle of each laser array with respect to a sub-scanning direction;

mY denotes a magnification of said scanning optical system on main scanning direction;

mZ denotes a magnification of said scanning optical system on sub-scanning direction;

fcol denotes the focal length of each coupling lens;

θ denotes half a crossing angle at which the laser beams emitted from said plurality of laser arrays cross therebetween;

γ denotes a maximum required rotational angle of said light-source unit in case of adjustment.

2. A multi-beam scanning device, scanning a to-be-scanned surface with a plurality of laser beams simultaneously, comprising:

a light-source unit comprising a plurality of laser arrays, each comprising a plurality of light-emitting points, a corresponding plurality of coupling lenses coupling laser beams emitted from said plurality of laser arrays, and a holding member integrally holding said plurality of laser arrays and plurality of coupling lenses rotatably approximately about optical axes of said laser arrays; and

a scanning optical system deflecting the laser beams emitted from said light-source unit and imaging them onto the to-be-scanned surface,

wherein said light-source unit and scanning optical system are configured so that the following equation be satisfied:

$$AZ = |q \times \text{sine}\ \phi \times (n-1) / (2 \times fcol \times \tan\theta \times \cos\gamma)| \leq 0.1$$

where:

n denotes the number of light-emitting points on each laser array;

q denotes an interval between each adjacent ones of the light-emitting points on each laser array;

ϕ denotes an inclination angle of each laser array with respect to a sub-scanning direction;

fcol denotes the focal length of each coupling lens;

θ denotes half a crossing angle at which the laser beams emitted from said plurality of laser arrays cross therebetween; and

γ denotes a maximum required rotational angle of said light-emitting unit in case of adjustment.

3. The multi-beam scanning device as claimed in claim 1, wherein the number of laser arrays on said light-source unit is two.

4. The multi-beam scanning device as claimed in claim 2, wherein the number of laser arrays on said light-source unit is two.

5. The multi-beam scanning device as claimed in claim 1, wherein the inclination angle of each laser array can be adjusted individually.

6. The multi-beam scanning device as claimed in claim 2, wherein the inclination angle of each laser array can be adjusted individually.

7. The multi-beam scanning device as claimed in claim 1, wherein each laser array is rotatably held by said holding member.

8. The multi-beam scanning device as claimed in claim 2, wherein each laser array is rotatably held by said holding member.

9. The multi-beam scanning device as claimed in claim 1, wherein said light-source unit and scanning optical system are configured such that a ratio A0 between a main-scanning-directional component and a sub-scanning-direction component of a change in beam-spot interval on the to-be-scanned surface occurring according to change in the inclination angle of each laser array satisfies the following equation:

$$1/3 \leq A0 \leq 3$$

where

$$A0 = |(mY/mZ) \times \tan \phi|$$

Where:

mY denotes a magnification of said scanning optical system on main scanning direction; and

mZ denotes a magnification of said scanning optical system on sub-scanning direction.

10. The multi-beam scanning device as claimed

in claim 2, wherein said light-source unit and scanning optical system are configured such that a ratio A0 between a main-scanning-directional component and a sub-scanning-direction component of a change in beam-spot interval on the to-be-scanned surface occurring according to change in the inclination angle of each laser array satisfies the following equation:

$$1/3 \leq A0 \leq 3$$

where

$$A0 = \left|(mY/mZ) \times \tan\phi\right|$$

Where:

mY denotes a magnification of said scanning optical system on main scanning direction; and

mZ denotes a magnification of said scanning optical system on sub-scanning direction.

11. A multi-beam scanning device, scanning a to-be-scanned surface with a plurality of laser beams

simultaneously, comprising:

a light-source unit comprising a plurality of laser arrays, each comprising a plurality of light-emitting points, a corresponding plurality of coupling lenses coupling laser beams emitted from said plurality of laser arrays, respectively, and a holding member integrally holding said plurality of laser arrays and plurality of coupling lenses rotatably approximately about optical axes of said laser arrays;

a scanning optical system deflecting the laser beams emitted from said light-source unit and imaging them onto the to-be-scanned surface; and

a part switching a scanning density on the to-be-scanned surface by rotating said light-source unit approximately about the optical axes of said laser arrays.

12. The multi-beam scanning unit as claimed in claim 11, further comprising a detecting part detecting a synchronization signal for determining a scanning start timing,

wherein:

said detecting part obtains the synchronization signal from a laser beam emitted from one of the light-emitting points of each of the laser arrays; and

scanning start timings on the other light-emitting points are determined as a result of shifting by specific delay times from the synchronization signal thus obtained.

13. The multi-beam scanning device as claimed in claim 11, wherein the number of the laser arrays provided is two.

14. The multi-beam scanning device as claimed in claim 11, wherein said light-source unit and scanning optical system are configured so that the following formula be satisfied:

$$\Delta RY = \left| \{(n-1)\times(2n-1)/2\}\times \{(q \times \cos\phi \times mY \times d)/(fcol \times \tan\theta \times mZ)\} \right| \leq d/4$$

where:

d denotes a scanning line interval on the to-be-scanned surface;

n denotes the number of light-emitting points on each laser array;

q denotes an interval between each adjacent ones of the light-emitting points one each laser array;

ϕ denotes an inclination angle of each laser array with respect to a sub-scanning direction;

mY denotes a magnification of said scanning optical system on main scanning direction;

mZ denotes a magnification of said scanning optical system on sub-scanning direction;

fcol denotes the focal length of each coupling lens;

θ denotes half a crossing angle at which the laser beams emitted from said plurality of laser arrays cross therebetween; and

ΔRY denotes the main-scanning-directional component of beam-spot interval between both ends of beam spots on the to-be-scanned surface for each laser array.

15. The multi-beam scanning device as claimed in claim 11, wherein said light-source unit and scanning optical system are configured so that the following formula be satisfied:

$$\Delta RZ = \left| \{(n-1)\times(2n-1)/2\}\times \{(q \times \sin \phi \times d)/(fcol \times \tan \theta)\} \right| \leq d/4$$

where:

d denotes a scanning line interval on the to-be-scanned surface;

n denotes the number of light-emitting points on each laser array;

q denotes an interval between each adjacent ones of the light-emitting points on each laser array;

ϕ denotes an inclination angle of each laser array with respect to a sub-scanning direction;

fcol denotes the focal length of each coupling lens;

θ denotes half a crossing angle at which the laser beams emitted from said plurality of laser arrays cross therebetween; and

ΔRZ denotes the sub-scanning-directional component of beam-spot interval between both ends of beam spots on the to-be-scanned surface for each laser array.

16. The multi-beam scanning device as claimed in claim 11, wherein delay times applied on the respective beam spots for scanning start timing are determined such that scanning start timing is optimum in case where a higher scanning density is applied through said switching part.

17. The multi-beam scanning device as claimed in claim 11, wherein delay times applied on the respective beam spots for scanning start timing are variable according to the scanning density switched.

18. An image formation apparatus comprising the multi-beam scanning device as claimed in claim 1.

19. An image formation apparatus comprising

the multi-beam scanning device as claimed in claim 2.

20. An image formation apparatus comprising the multi-beam scanning device as claimed in claim 11.

21. An image formation apparatus comprising:

a plurality of photoconductor members to provide to-be-scanned surfaces; and

the multi-beam scanning device claimed in claim 1 scanning at least one of said to-be-scanned surfaces.

22. An image formation apparatus comprising:

a plurality of photoconductor members to provide to-be-scanned surfaces; and

the multi-beam scanning device claimed in

claim 2 scanning at least one of said to-be-scanned surfaces.

23. An image formation apparatus comprising:

a plurality of photoconductor members to provide to-be-scanned surfaces; and

the multi-beam scanning device claimed in claim 11 scanning at least one of said to-be-scanned surfaces.

24. A multi-beam scanning device, scanning a to-be-scanned surface with a plurality of laser beams simultaneously, comprising:

light-source unit comprising a plurality of laser means, each comprising a plurality of light-emitting points, a corresponding plurality of coupling means for coupling laser beams emitted from said plurality of laser arrays, and a holding means for integrally holding said plurality of laser means and

plurality of coupling means rotatably approximately about optical axes on the laser means; and

a scanning optical system deflecting the laser beams emitted from said light-source unit and imaging them onto the to-be-scanned surface,

wherein said light-source unit and scanning optical system are configured so that the following equation be satisfied:

$$AY = |q \times \cos\phi \times mY \times (n-1) / (2 \times fcol \times \tan\theta \times \cos\gamma \times mZ)| \leq 0.1$$

where:

n denotes the number of light-emitting points on each laser means;

q denotes an interval between each adjacent ones of the light-emitting points on each laser means;

ϕ denotes an inclination angle of each laser means with respect to a sub-scanning direction;

mY denotes a magnification of said scanning optical system on main scanning direction;

mZ denotes a magnification of said scanning optical system on sub-scanning direction;

fcol denotes the focal length of each coupling means;

θ denotes half a crossing angle at which the

laser beams emitted from said plurality of laser means cross therebetween; and

γ denotes a maximum required rotational angle of said light-emitting unit in case of adjustment.

25. A multi-beam scanning device, scanning a to-be-scanned surface with a plurality of laser beams simultaneously, comprising:

a light-source unit comprising a plurality of laser means, each comprising a plurality of light-emitting points, a corresponding plurality of coupling means for coupling laser beams emitted from said plurality of laser means, and holding means for integrally holding said plurality of laser means and plurality of coupling means rotatably approximately about optical axes on the laser means; and

a scanning optical system deflecting the laser beams emitted from said light-source unit and imaging them onto the to-be-scanned surface,

wherein said light-source unit and scanning optical system are configured so that the following equation be satisfied:

$$AZ = |q \times \text{sine}\ \phi \times (n-1) / (2 \times fcol \times \tan\theta \times \cos\gamma)| \leq 0.1$$

where:

n denotes the number of light-emitting points on each laser means;

q denotes an interval between each adjacent ones of the light-emitting points on each laser means;

ϕ denotes an inclination angle of each laser means with respect to a sub-scanning direction;

fcol denotes the focal length of each coupling means;

θ denotes half a crossing angle at which the laser beams emitted from said plurality of laser means cross therebetween; and

γ denotes a maximum required rotational angle of said light-source unit in case of adjustment.

26. The multi-beam scanning device as claimed in claim 24, wherein the number of laser means on said light-source unit is two.

27. The multi-beam scanning device as claimed in claim 25, wherein the number of laser means on said light-source unit is two.

28. The multi-beam scanning device as claimed in claim 24, wherein the inclination angle of each laser means can be adjusted individually.

29. The multi-beam scanning device as claimed in claim 25, wherein the inclination angle of each laser means can be adjusted individually.

30. The multi-beam scanning device as claimed in claim 24, wherein each laser means is rotatably held by said holding means.

31. The multi-beam scanning device as claimed in claim 25, wherein each laser means is rotatably held by said holding means.

32. The multi-beam scanning device as claimed in claim 24, wherein said light-source unit and scanning optical system are configured such that a ratio A0 between a main-scanning-directional component and a sub-scanning-direction component of a change in beam-spot interval on the to-be-scanned surface occurring according to change in the inclination angle of each laser means satisfies the following equation:

$$1/3 \leq A0 \leq 3$$

where

$$A0 = \left|(mY/mZ) \times \tan\phi\right|$$

where:

mY denotes a magnification of said scanning optical system on main scanning direction; and

mZ denotes a magnification of said scanning optical system on sub-scanning direction.

33. The multi-beam scanning device as claimed in claim 25, wherein said light-source unit and scanning optical system are configured such that a ratio A0 between a main-scanning-directional component and a sub-scanning-direction component of a change in beam-spot interval on the to-be-scanned surface occurring according to change in the inclination angle of each laser means satisfies the following equation;

$$1/3 \leq A0 \leq 3$$

where

$$A0 = \left|(mY/mZ) \times \tan \phi\right|$$

Where:

mY denotes a magnification of said scanning optical system on main scanning direction; and

mZ denotes a magnification of said scanning

optical system on sub-scanning direction.

34. A multi-beam scanning device, scanning a to-be-scanned surface with a plurality of laser beams simultaneously, comprising:

a light-source unit comprising a plurality of laser means, each comprising a plurality of light-emitting points, a corresponding plurality of coupling means coupling laser beams emitted from said plurality of laser means, and holding means integrally holding said plurality of laser means and plurality of coupling means rotatably approximately about optical axes on the laser means;

a scanning optical system deflecting the laser beams emitted from said light-source unit and imaging them onto the to-be-scanned surface; and

means for switching a scanning density on the to-be-scanned surface by rotating said light-source unit approximately about the optical axes of the laser means.

35. The multi-beam scanning unit as claimed in claim 34, further comprising detecting means for detecting a synchronization signal for determining a scanning start timing,

wherein:

said detecting means obtains the synchronization signal from a laser beam emitted from one of the light-emitting points of each laser means; and

scanning start timings on the other light-emitting points are determined as a result of shifting by specific delay times from the synchronization signal thus obtained.

36. The multi-beam scanning device as claimed in claim 34, wherein the number of laser means provided is two.

37. The multi-beam scanning device as claimed

in claim 34, wherein said light-source unit and scanning optical system are configured so that the following formula be satisfied:

$$\Delta RY = \left|\{(n-1)\times(2n-1)/2\}\times \{(q \times \cos\phi \times mY \times d)/(fcol \times \tan\theta \times mZ)\}\right| \leq d/4$$

where:

d denotes a scanning line interval on the to-be-scanned surface;

n denotes the number of light-emitting points on each laser means;

q denotes an interval between each adjacent ones of the light-emitting points on each laser means;

ϕ denotes an inclination angle of each laser means with respect to a sub-scanning direction;

mY denotes a magnification of said scanning optical system on main scanning direction;

mZ denotes a magnification of said scanning optical system on sub-scanning direction;

fcol denotes the focal length of each coupling means;

θ denotes half a crossing angle at which the laser beams emitted from said plurality of laser means cross therebetween; and

ΔRY denotes the main-scanning-directional component of beam-spot interval between both ends of beam spots on the to-be-scanned surface for each laser means.

38. The multi-beam scanning device as claimed in claim 34, wherein said light-source unit and scanning optical system are configured so that the following formula be satisfied:

$$\Delta RZ = \left|\{(n-1)\times(2n-1)/2\}\times \{(q \times \sin\phi \times d)/(fcol \times \tan\theta)\}\right| \leq d/4$$

where:

d denotes a scanning line interval on the to-be-scanned surface;

n denotes the number of light-emitting points on each laser means;

q denotes an interval between each adjacent ones of the light-emitting points on each laser means;

ϕ denotes an inclination angle of each laser means with respect to a sub-scanning direction;

mZ denotes a magnification of said scanning

optical system on sub-scanning direction;

fcol denotes the focal length of each coupling means;

θ denotes half a crossing angle at which the laser beams emitted from said plurality of laser means cross therebetween; and

ΔRZ denotes the sub-scanning-directional component of beam-spot interval between both ends of beam spots on the to-be-scanned surface from each laser means.

39. The multi-beam scanning device as claimed in claim 34, wherein delay times applied on the respective beam spots for scanning start timing are determined such that scanning start timing is optimum in case where a higher scanning density is applied through said switching part.

40. The multi-beam scanning device as claimed

in claim 34, wherein delay times applied on the respective beam spots for scanning start timing are variable according to the scanning density switched.

41. An image formation apparatus comprising the multi-beam scanning device as claimed in claim 24.

42. An image formation apparatus comprising the multi-beam scanning device as claimed in claim 25.

43. An image formation apparatus comprising the multi-beam scanning device as claimed in claim 34.

44. An image formation apparatus comprising: a plurality of photoconductor members to provide to-be-scanned surfaces; and the multi-beam scanning device claimed in claim 24 scanning at least one of said to-be-scanned surfaces.

45. An image formation apparatus comprising: a plurality of photoconductor members to provide to-be-scanned surfaces; and the multi-beam scanning device claimed in claim 25 scanning at least one of said to-be-scanned surfaces.

46. An image formation apparatus comprising: a plurality of photoconductor members to provide to-be-scanned surfaces; and the multi-beam scanning device claimed in claim 34 scanning at least one of said to-be-scanned

surfaces.